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OUR EXPERIENCES WITH GASTROENTEROSTOMY: A STUDY
OF ONE HUNDRED CASES AS COMPARED WITH A
SIMILAR NUMBER OF CASES OF PYLOROPLASTY.¹

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A YEAR ago we reported our thirteen years' experience with pyloroplasty, and from a study of 100 cases the following conclusions were drawn:

1. The operation has certain advantages over gastroenterostomy, and but few of its disadvantages.

2. The operation has its greatest indication in the relief of pyloric stenosis due to chronic ulcers, situated at or near the pylorus, and on either side of it, or resulting from cicatricial contraction following the healing of such ulcers. It is often a useful procedure in cases of hemorrhage due to gastric ulcers on the lesser curvature, or to duodenal ulcers which cannot be controlled medically, and which threaten the life of the patient, as well as in the chronic dyspepsias due to ulcers which have not been relieved by medical treatment.

3. The special advantages of this operative procedure lie in its affording the opportunity to excise all ulcers whether perforated or

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not in the anterior walls of the stomach or duodenum after direct inspection of the part affected; also the application of treatment to ulcers situated in the posterior walls. It does not greatly disturb the normal relation between the stomach and intestines, as is the case in other operations.

4. Such objections as are urged against the operation, *e. g.*, its inapplicability in the presence of adhesions surrounding the pylorus, as well as in the presence of active and bleeding ulcers, and also because of the fact that the new opening is not at its lowest point, taking advantage of gravity, are according to our experience more fanciful than real, since the operation has frequently been performed under these conditions with most gratifying results. The interesting experimental work of Cannon and Blake and others supports this contention.

5. The only contra-indications to the operation are inability to mobilize the duodenum when adhesions are too dense, and thickening and infiltration about the pylorus due to hypertrophic forms of ulceration. These conditions, however, in our experience occur but rarely.

6. In atony or gastroparesis with slight motor insufficiency such as is observed in the water-trap stomach, or in nervous dyspepsia, *i. e.*, in gastric disturbances not dependent upon organic disease, this operation is contra-indicated.

7. From our experience with the operation the immediate as well as the final results are most encouraging. While in some instances partial gastrectomy or gastroenterostomy is undoubtedly the operation of choice, nevertheless, on account of its simplicity and because of its satisfactory end results, we believe that pyloroplasty will continue to retain its position as a safe and useful procedure.

Inasmuch as our results with pyloroplasty appeared to be so much more satisfactory than with gastroenterostomy, it seemed to us that it would be well to bring together the results of the later operation, compare them in detail with those of pyloroplasty, and determine whether any advantage really existed in favor of pyloroplasty. For this reason we have collected together 100 cases taken consecutively, beginning in 1902 the date at which the operation of pyloroplasty was first introduced. In gathering our experiences we deem it most important, as with our pyloroplasty cases, that not only should the immediate effects be noted, but also the final results, that is, the results obtained after a term of years.

It is also of importance to note that only those cases have been included in this report in which the gastroenterostomy was performed for other than malignant conditions. All cases in which there has been the slightest question of malignancy have been excluded from this series.

Of the gastroenterostomy cases the immediate results were noted in all cases; the remote results in 74 cases.

In analyzing our results we note that the largest proportion of cases in which it was performed occurred between the thirtieth and sixtieth years.

CASES ARRANGED ACCORDING TO AGE.

Years.	No.	Per cent.	Years.	No.	Per cent.
20 to 25	6	6	45 to 50	12	12
25 to 30	7	7	50 to 55	15	15
30 to 35	10	10	55 to 60	12	12
35 to 40	14	14	60 to 65	5	5
40 to 45	16	16	65 to 70	3	3

Of the total number there are 56 males and 44 females. The following tables illustrate the number of cases observed in males and females according to age:

Years.	Males.		Females.		Total.	
	No.	Per cent.	No.	Per cent.	No.	Per cent.
20 to 25	2	2	4	4	6	6
25 to 30	4	4	3	3	7	7
30 to 35	6	6	4	4	10	10
35 to 40	6	6	8	8	14	14
40 to 45	10	10	6	6	16	16
45 to 50	8	8	4	4	12	12
50 to 55	8	8	7	7	15	15
55 to 60	6	6	6	6	12	12
60 to 65	4	4	1	1	5	5
65 to 70	2	2	1	1	3	3
Total	56	56	44	47	100	100

The duration of the symptoms in our cases varied greatly, ranging from one month to nineteen years, the average duration being nine and a half years.

The following table presents the cases grouped according to the duration of symptoms:

CASES GROUPED ACCORDING TO DURATION OF SYMPTOMS.

Time.	No. of cases.	Time.	No. of cases.
1 month	1	7 years	8
2 "	2	8 "	6
3 "	1	9 "	2
4 "	1	10 "	2
6 "	4	11 "	3
7 "	2	12 "	1
9 "	1	13 "	1
11 "	3	14 "	2
1 year	10	15 "	3
2 years	8	16 "	2
3 "	11	18 "	2
4 "	7	19 "	2
5 "	12		

Average duration of symptoms, nine and a half years.

We have noted the principal symptoms observed in both males and females at various ages. Of these pain was observed in 90 per cent.

of cases (51 males and 39 females); vomiting occurred in 65 per cent. of cases (36 males and 29 females); hematemesis in 23 per cent. (18 males and 5 females); melena in 44 per cent. (28 males and 16 females); retention in 36 per cent. (19 males and 17 females).

PRINCIPAL SYMPTOMS OBSERVED.

Age.	Pain.			Vomiting.			Hematemesis.			Melena.			Retention.		
	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.	M.	F.	Total.
20 to 30 years . . .	4	6	10	4	5	9	1	0	1	3	6	9	2	2	4
30 to 40 " . . .	11	10	21	8	6	14	4	2	6	7	5	12	6	6	12
40 to 50 " . . .	17	10	27	12	8	20	8	2	10	9	2	11	7	6	13
50 to 60 " . . .	13	12	25	8	9	17	4	1	5	6	3	9	2	3	5
60 to 70 " . . .	6	1	7	4	1	5	1	0	1	3	0	3	2	0	2
Total . . .	51	39	90	36	29	65	18	5	23	28	16	44	19	17	36

In the following table we have arranged the cases of gastric and duodenal ulcers according to age and sex. There are 46 cases of gastric ulcer (32 males and 14 females) and 38 duodenal ulcers (15 males and 23 females) making a total of 84 cases. In addition gastroenterostomy was performed upon 4 cases for gastroptosis, in 2 for pylorospasm, and 9 for pyloric stenosis, due to adhesions (2 due to cholelithiasis, 7 due to adhesions of undetermined cause, probably old healed ulcers). One case presented both gastric and duodenal ulcers.

GROUPING OF THE GASTRIC AND DUODENAL ULCERS ACCORDING TO AGE AND SEX.

Age.	Males.		Females.	
	Gastric. No.	Duodenal. No.	Gastric. No.	Duodenal. No.
20 to 30 . . .	4	1	2	3
30 to 40 . . .	6	2	2	8
40 to 50 . . .	12	5	3	6
50 to 60 . . .	8	4	6	6
60 to 70 . . .	2	3	1	0
Total . . .	32	15	14	23

Of the 84 cases, obstruction of the pylorus occurred in 67 instances. The obstruction was due in 44 cases to gastric ulcer, in 14 to duodenal ulcer, and in 9 to adhesions. There were 4 cases in which gastroenterostomy was required as secondary to pyloroplasty.

CASES REQUIRING GASTROENTEROSTOMY AS SECONDARY TO PYLOROPLASTY.

Age.	Sex.	Cases.
58 years	F.	Pyloric obstruction due to adhesions produced by gall-bladder infection eleven years after pyloroplasty.
52 "	M.	Duodenal ulcer formed five years after pyloroplasty.
48 "	M.	Infected sutures causing immediate obstruction at site of pyloroplasty requiring gastroenterostomy after five days.
41 "	M.	Duodenal ulcer after one and one-half years.

In one case there occurred a pyloric obstruction due to adhesions produced by cholecystitis eleven years after the pyloroplasty. In the second, a duodenal ulcer formed four years after the pyloroplasty. In the third infected sutures (linen thread) caused early obstruction at the site of the pyloroplasty, and in the fourth, a duodenal ulcer formed after a year and a half. In all of these cases secondary gastroenterostomies had to be performed, which gave entire relief. In our gastroenterostomy cases secondary operations were necessitated in four instances. In one case there was a vicious circle; an entero-anastomosis was made on the day following the operation, and the patient died two days later. In two instances the gastroenterostomy opening became obstructed by adhesions, after one year and one year and a half respectively, secondary gastroenterostomies were performed.

In a fourth instance a secondary gastroenterostomy was performed after the old gastroenterostomy opening had become obstructed after a period of three years.

CASES REQUIRING SECONDARY GASTROENTEROSTOMIES.

Cases.	Age.	Sex.	Cause.
I . . .	70 years	M.	Vicious circle.
II . . .	24 "	F.	Obstruction from adhesions after one year.
III . . .	35 "	F.	Obstruction from adhesions one and a half years.
IV . . .	53 "	M.	Obstruction from adhesions after three years.

It is only fair to call attention to the fact that some of the earlier of the gastroenterostomies were performed by the method then in vogue—namely, the anterior long-loop anastomosis, which did not yield so satisfactory results as those obtained by the no-loop posterior anastomosis. By far the larger number, however, were done after the latter method.

The following table illustrates the immediate results of gastroenterostomy of the 100 cases, consisting of 56 males and 44 females; the operations proved satisfactory immediately in 45 males and 37 females (82 per cent.) and unsatisfactory in 11 males and 7 females (18 per cent.).

In contrast with the immediate results of pyloroplasty, post-operative nausea and vomiting are not infrequent after gastroenterostomy. There are but few instances in our series in which marked nausea did not appear; vomiting was present in 72 of our 100 cases, while flatulency and distention were not infrequent. When one notes the great freedom from discomfort following immediately after pyloroplasty, there can be no question as to the distinct immediate advantage of this procedure over gastroenterostomy.

It is but fair to state, however, that the nausea and vomiting have been at times induced by improper feeding, produced by overdistention and weighing down of the fundus, and thus tending to produce a temporary closure of the new opening. In a number

of instances this condition was overcome by relieving the over-distention and increasing the tone of the stomach by means of lavage.

Diarrhea after operation appeared in eight instances, mainly, however, after the first week or ten days, and was usually due to errors in diet. Inasmuch as the operation is performed in most instances upon patients affected with pyloric obstruction, and after having had this condition for years, it is easily understood how, on account of the rapid passage of the gastric contents through the stomach, a weakened intestine may be overtaxed and intestinal indigestion and diarrhea be induced. On this account, as well as because the stomach has in most instances temporarily lost its tone; and inasmuch as in some cases active ulcers are still present, we have found it advisable to regulate the diet following immediately upon operation and continuing on for several months according to the following plan, which has been found very satisfactory. On account of the frequent occurrence of gastrointestinal upsets after gastroenterostomy we have, according to our experience, found it more important to follow the following dietetic restrictions than after pyloroplasty.

For two days after operation nourishment is administered only by means of rectal alimentation. Normal salt solution or plain water, after Murphy's method, is begun immediately after operation, with nutrient enemata at intervals of every four hours on the second and third days. On the third day after operation, egg-albumin is given in teaspoonful doses, gradually increased to one-half ounce every two hours on the fourth day and two ounces on the fifth day. On the eighth day any liquid is permissible, and on the eleventh day the patient is given a soft-boiled egg; on the thirteenth, soft diet; on the fifteenth, very restricted light diet; on the sixteenth, a restricted light diet; on the eighteenth day, light solid food. Small quantities of water at a time are allowed by mouth after twenty-four hours.

Diet List following the Operation of Gastroenterostomy. First day, first twelve hours, nothing by mouth; nutrient enemata every four hours alternating with continuous salt solution by Murphy's method.

First day, second twelve hours: water in dram doses.

Second day: increase water gradually up to 1 ounce every two hours.

Third day: water 1 ounce, alternating with albumin, 1 dram.

Gradually increase quantities of each until

Eighth day: any liquid 2 ounces every two hours.

Ninth day: any liquid, 3 ounces every two hours.

Tenth day: any liquid, 4 ounces every two hours (discontinue rectal feeding).

Eleventh day: one soft-boiled egg in addition to any liquid.

Twelfth day: two soft-boiled eggs in addition to any liquid.

Thirteenth day: soft diet.

Fourteenth day: soft diet.

Fifteenth day: very restricted light diet.

Sixteenth day: restricted light diet.

Seventeenth day: restricted light diet.

Eighteenth day: any digestible solid food.

After the eighteenth day the following diet list may be gradually followed, and should be continued for at least four or five months: Soups: any light soup. Meats: any of the easily digestible meats, as brains, sweetbreads, beef, mutton, lamb, or poultry (best minced, and taken either broiled or boiled). Fish: mainly the white variety, mackerel, rock, bass, as well as oysters (boiled or broiled). Eggs: in any form except fried. Vegetables: best taken mashed and strained; the easily digestible forms, as asparagus, spinach, peas, beans, potatoes, carrots. Farinaceous food: any of the cereals; bread to be taken stale. Desserts: any of the light puddings. Fruits: mainly stewed. Fatty food: cream, butter, and olive oil. Drinks: milk, buttermilk, cocoa, carbonated mineral water, and plain water.

The following must be avoided: Rich soups, fried foods, pork, veal, stews, hashes, corned meats, potted meat, twice cooked meat, liver, kidney, duck, goose, sausage, crabs, sardines, lobster, preserved fish, smoked fish, salted fish, salmon, cauliflower, celery, radishes, cabbage, cucumbers, sweet potatoes, tomatoes, beets, corn, salads, bananas, melons, berries, pineapple, hot bread, or cakes, nuts, canlies, pies, pastry, preserves, cheese, strong tea, strong coffee, alcoholic stimulants.

IMMEDIATE RESULTS OF OPERATION.

Age.	Males.		Females.	
	Satisfactory.	Unsatisfactory.	Satisfactory.	Unsatisfactory.
20 to 30 years . . .	5	1	5	2
30 to 40 " . . .	8	4	10	2
40 to 50 " . . .	16	2	9	1
50 to 60 " . . .	12	2	11	2
60 to 70 " . . .	4	2	2	0
Total . . .	45	11	37	7

In order to obtain a clear view as to the immediate results of the operation we have compared the gastric secretion in the following two cases of pyloric stenosis due to ulcer, before the operation with that obtained one, two, and three months after operation. The figures given are an average of a number of examinations. The total acidity is first noted, then the amount of free hydrochloric acid, and finally the quantity of contents recovered, which in a measure represents the motor activity of the stomach. It is evident in every case that the total quantity of acid as well as the percentage of free hydrochloric acid, which may be exceedingly high before operation, is gradually reduced to normal, but that this does not occur immediately after operation, but requires about two to three

months before the normal is established, after which it continues to remain stationary. Similarly the large quantity of contents obtained is gradually reduced to normal after operation, while the retention observed at first entirely vanishes. It is, therefore, evident that while the secretory and motor functions of the stomach are at once markedly improved after gastroenterostomy, these functions do not usually become normal immediately, but just as in the pyloroplasty cases several months must elapse before perfectly normal conditions are established.

	Total acidity,	Free HCl.	Quantity of contents:	
			After test meal,	On fasting stomach,
M. J. operation:				
June 27, 1908				
Before operation:				
May 5, 1908 . . .	120	74	280	210
After operation:				
July 24, 1908 . . .	82	70	100	0
July 30, 1908 . . .	62	62	86	0
Aug. 10, 1908 . . .	46	38	54	0
Sept. 2, 1908 . . .	42	30	50	0
R. R. operation:				
June 27, 1909				
Before operation:				
May 11, 1909 . . .	105	82	310	230
After operation:				
Aug. 2, 1909 . . .	100	72	96	0
Aug. 30, 1909 . . .	88	66	55	0
Sept. 15, 1909 . . .	44	32	45	0

Deaths following Operations. There were seven deaths following immediately upon operation; these occurred from the third to the thirty-third day. In one instance death was due to pneumonia following a secondary gastroenterostomy for a vicious circle; in a second, death was sudden, due to pulmonary embolism; in a third, it was due to toxemia from an intestinal obstruction; in a fourth to persistent vomiting, due to a vicious circle; in a fifth, to exhaustion from a postoperative diarrhea, and in a sixth and seventh to bronchopneumonia in debilitated individuals.

The following table illustrates the number of deaths following immediately upon operation, with cause of death:

IMMEDIATE RESULTS—DEATHS.			
No.	Sex.	Day of death after operation.	Cause of death.
I . . .	M.	3	Pneumonia following a secondary gastroenterostomy for a vicious circle.
II . . .	M.	7	Sudden death due to pulmonary embolism.
III . . .	M.	23	Toxemia due to intestinal obstruction from inflammatory growth.
IV . . .	M.	33	Persistent vomiting due to vicious circle.
V . . .	F.	16	Exhaustion, persistent postoperative diarrhea.
VI . . .	F.	5	Bronchopneumonia following one day after operation in a weakened patient; death on fifth day.
VII . . .	M.	4	Bronchopneumonia in a very weak man.

The results of gastroenterostomy during the first year of the operation are fairly satisfactory. Of the 100 cases operated on, 7 had died immediately following operation, and the results of 16 could not be obtained; the results are therefore tabulated in only 77 cases, consisting of 43 males and 34 females; the results were entirely satisfactory in 34 males and 31 females, that is in 65 instances (84.4 per cent.), and unsatisfactory in 9 males and 3 females, that is in 12 instances (15.6 per cent.).

RESULTS OF OPERATION DURING FIRST YEAR.

Age.	Males.		Females.	
	Satisfactory.	Unsatisfactory.	Satisfactory.	Unsatisfactory.
20 to 30 years . . .	4	1	5	1
30 to 40 " . . .	8	1	9	1
40 to 50 " . . .	12	4	7	0
50 to 60 " . . .	8	1	9	1
60 to 70 " . . .	2	2	1	0
Total . . .	34	9	31	3

Of the total of 100 cases the final results of 19 are unknown while 7 died soon after operation, leaving 74 cases. Of these the results were satisfactory in 32 males and 29 females, that is, 61 (84.2 per cent.) and unsatisfactory in 8 males and 5 females, that is, 13 (15.8 per cent.).

RESULTS AFTER FIRST YEAR OF REMAINING SEVENTY-FOUR CASES.

Age.	Males.		Females.	
	Satisfactory.	Unsatisfactory.	Satisfactory.	Unsatisfactory.
20 to 30 years . . .	3	1	1	1
30 to 40 " . . .	8	2	8	2
40 to 50 " . . .	11	3	7	0
50 to 60 " . . .	8	1	9	1
60 to 70 " . . .	2	1	1	1
Total . . .	32	8	29	5

In the following table are noted the number of cases that have been observed from one to eleven years after operation together with the final results. The average of the satisfactory recoveries is shown to be 84.2 per cent. If we deduct from this number 7 per cent. that those cases already referred to, in which death occurred immediately upon operation, the percentage of favorable results is reduced to 77.2 per cent.

In a series of Roentgen-ray plates made in four cases, all of which had been operated on over a year, it was demonstrated that while in most instances the gastroenterostomy opening was functioning quite normally a portion of the gastric contents continued to empty itself through the pylorus.

END RESULTS IN YEARS AFTER OPERATION OF GASTROENTEROSTOMY.

Years.	Total No. of cases.	Satisfactory results.	Unsatisfactory results.	Percentage of satisfactory recoveries.
1	9	8	1	88.8
2	5	5	0	100.0
3	8	7	1	87.5
4	7	6	1	85.7
5	4	3	1	75.0
6	7	5	2	71.4
7	5	5	0	100.0
8	9	9	0	100.0
9	7	6	1	85.7
10	8	6	2	75.0
11	5	3	2	60.0
Average of percentage of satisfactory recoveries				84.2
Deaths				7.0
Favorable results				77.2

From our observations of a study of 100 cases of gastroenterostomy we believe we are justified in arriving at the following conclusions:

1. The largest proportion of cases in our series in which gastroenterostomy was performed occurred between the thirtieth and sixtieth years, while the largest proportion of cases in which pyloroplasty was performed occurred between the thirty-fifth and fiftieth years.

2. Of the total number of cases of gastroenterostomy there were 56 males and 44 females, while the total number in the pyloroplasty series numbers 63 males and 37 females.

3. The duration of the symptoms in our gastroenterostomy cases varied from one month to nineteen years, the average duration being nine and a half years, while the duration of symptoms in our pyloroplasty cases varied between one and one half months to twenty-five years, the average duration being nine and a half years.

4. In the gastroenterostomy cases the symptoms appeared in the following proportions: pain 90 per cent. (51 males and 39 females); vomiting in 65 per cent. (36 males and 29 females); hematemesis in 23 per cent. (18 males and 5 females); melena in 44 per cent. (28 males and 16 females); retention in 36 per cent. (19 males and 17 females); while in the pyloroplasty cases pain was present in 92 per cent. of cases (58 males and 34 females); vomiting in 64 per cent. (44 males and 20 females); hematemesis in 21 per cent. (15 males and 6 females); melena in 46 per cent. (29 males and 17 females); retention in 42 per cent. (27 males and 15 females).

5. In the gastroenterostomy series the ulcer cases are arranged as follows: there are 46 cases of gastric ulcer (32 males and 14 females), 38 duodenal ulcers (15 males and 23 females), making a total of 84 cases. In the pyloroplasty cases there were 55 cases of gastric ulcer (36 males and 19 females) and 32 duodenal ulcers (21 males and 11 females, making a total of 87 cases. It will be noted that in both series there is a preponderance of males over females, and of gastric over duodenal ulcers.

6. In 67 of the gastroenterostomy patients operated on for obstruction 44 were due to gastric ulcer, 14 to duodenal ulcer, and 9 to adhesions, while pyloroplasty was performed for obstruction in 64 instances; for gastric ulcer in 51, for duodenal ulcer in 7, and in 6 for adhesions.

7. In our gastroenterostomy cases secondary operations were performed in four instances to correct immediate difficulties while in the pyloroplasty cases secondary operations were required in the same number of instances for a similar purpose.

8. After gastroenterostomy satisfactory results were secured in 82 per cent. of cases, and unsatisfactory in 18 per cent., while pyloroplasty was immediately successful in 90 per cent. cases and unsatisfactory in 10 per cent.

9. There were seven deaths, following immediately upon the operation of gastroenterostomy, while but five deaths followed pyloroplasty.

10. Of the 77 cases of gastroenterostomy followed during the first year of the operation the results were satisfactory in 84.4 per cent. and unsatisfactory in 15.6 per cent., while of the 82 cases of pyloroplasty the results were entirely satisfactory in 93.9 per cent., and unsatisfactory in 6.1 per cent.

11. Of the gastroenterostomy cases numbering 74 followed after the first year of operation, the results were satisfactory in 84.2 per cent., and unsatisfactory in 15.8 per cent., while of the pyloroplasty cases numbering 78, the results were satisfactory in 93.6 per cent., and unsatisfactory in 6.4 per cent.

12. The end results in the gastroenterostomy cases showed a percentage of 77.2 per cent. of satisfactory recoveries, while the pyloroplasty cases showed a percentage of 88.6 per cent.

It is quite evident from our study of 100 gastroenterostomy operations and from a similar number of pyloroplasties that the immediate as well as the final results are clearly in favor of pyloroplasty. The only indications in favor of gastroenterostomy are, as we have already pointed out, in those instances in which there is an inability to mobilize the duodenum when adhesions are too dense, and in those cases in which there is a thickening and infiltration about the pylorus due to hypertrophic ulceration, conditions, however, which in our experience occur but rarely. Again there is no possibility of excising the ulcers when performing gastroenterostomy, as can frequently be accomplished in pyloroplasty, when they are in the anterior wall.

While in some instances gastroenterostomy may be the operation of choice, nevertheless we believe that on account of its comparative unsatisfactory end results, it should be as far as possible limited to the relief of stenosis of the pylorus, due to malignant disease, and that usually in nearly all other conditions pyloroplasty and pylorotomy are safer and more satisfactory procedures.